OKLAHOMA
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION
STILLWATER, OKLAHOMA

SILOS AND SILAGE

By
L. E. Hazen, W. L. Blizzard
and P. C. McGilliard

Circular No. 60 May, 1926

SILOS AND SILAGE

Silos were used for storing food a great many years ago. The Greeks and Romans used silos for storing green feed for stock. Their silos consisted of pits or trenches in the ground. Many of this type are in use at present in the semi-arid sections of the United States.

The early development of silos was slow. The first one built in the United States was put into use in 1875 by Manly Miles of Michigan. In 1882 there were only ninety-two silos in use in this country. Later the increase in the number of silos became more rapid, especially in states where the dairy industry was important, in some cases often doubling the number each year over that of the previous year.

In Oklahoma where less attention was paid to livestock farming than in some other states and where the pasturage season is longer, the increase in silos has been less rapid. Livestock farmers in general recognize the necessity of the silo. It stands today among the most important practical and profitable adjuncts of the farm. It is a paying investment and not an expense. It is especially valuable in connection with dairy farming and Oklahoma is making much progress in dairying.

Advantages of Silage

The advantages of conserving field crops as silage may be summed up as follows:

1. Silage is relished by most kinds of livestock.
2. A sure crop of desirable roughage is assured.
3. The nutrients of the entire crop are saved.
4. A large yield per acre is secured at a relatively low cost.
5. A succulent food is nature's food. Silage furnishes pasture conditions in winter or during dry summers.
6. Eliminates danger of loss of corn or kafir from late summer droughts.
7. Increases the stock capacity of the farm.
8. It is the most economical storage of feed.
9. Palatable food can be made from non-palatable.
10. It furnishes food of uniform quality.
11. Weather conditions do not affect feeding from a silo.
12. It is convenient to feed.
13. It lessens the labor of feeding.
14. Corn stalks are saved and a person is not bothered with them in the manure.
15. It is a stepping stone to better methods in general.

SILAGE FOR MILK COWS

Dairy cows must have some succulent feed in the ration for the best results. Pasture furnishes this in the spring and is nature's most desirable succulent feed. Cows seem to produce best while on pasture so the dairymen must try in some way to imitate the spring conditions during those parts of the year when pasture is not available.

Silage seems to imitate these conditions more nearly than any other feed. Where dairying is carried on extensively it is considered a necessity for winter feeding and in many sections it is fed throughout the entire year. Silage is especially good to supplement the short pasture during late summer and fall, as not enough material can be gathered by the cows when pasture is short. Silage fed at this time will aid materially in keeping up the production.

Silage is one of the best and most economical roughages. Its cost, its succulence, its stimulating effect upon the appetite and its good physiological effect all recommend it as a feed for dairy cows.

Silage is valuable for feeding young stock. Calves will consume small amounts at two months of age, and after six months old, can be raised very economically upon silage and legume hay.

Milk cows being fed some good legume hay and grain will consume 30 to 50 pounds of silage per day, depending upon the size of the cow. During pasture season this can be reduced to one-half that amount.

Bulls should not be fed heavily upon silage at any time and when used for heavy service should not receive any silage.

To keep silage from spoiling in the silo it is necessary to feed at least two inches per day in winter and 3 inches per day in summer. The following table shows the weight of silage contained in two inches from silos of different diameters.

Average Weight of Two Inches of Silage

Diameter of Silo	Weight of 2 Ins.	Number of Milk Cows Necessary
8 ft.	300	10
10 ft.	510	17
12 ft.	735	24
14 ft.	1000	33

—o—

SILAGE AS A FEED FOR BEEF CATTLE

Silage is a roughage and there is probably no other roughage which is of more importance to the producer of beef cattle. It is a great saver of grain, regardless of whether it is to be used for feeding stock cattle or for finishing cattle for the market. It will lessen the grain to be fed by practically the same amount as is contained in the silage.

Silage is particularly valuable for wintering the breeding herd because of its bulk and succulence. Cattle that are fed on silage, with the addition of wheat straw, prairie hay or alfalfa hay, will go through the winter in excellent

shape, gaining some in weight and will produce strong, vigorous calves. If alfalfa hay is not available, some protein supplement, such as cottonseed meal or cake, should be used with silage and the cattle should be allowed from one to two pounds of meal per head daily. It is also advisable to provide some dry, coarse fodder or straw for cattle being fed on silage. Cows of mature age and of good size will consume between thirty and forty pounds of silage per head daily where the amount of dry feed is limited. Silage is especially beneficial for wintering calves as they will take to the silage ration quicker than to dry feed and there is less loss in weight from weaning. Calves that are wintering on silage, alfalfa hay or cottonseed meal, together with some dry roughage, will come through the winter with plenty of growth and with considerable increase in weight.

Silage is being widely used for finishing cattle. It has grown more popular as a roughage for finishing cattle with the advanced price of corn and other grains. The cost of grain at the present time is a limiting factor in beef cattle production. The high price of grain has caused the feeder to look about for methods of cheapening the cost of beef production and the cost of beef production can be reduced materially by the use of roughages. There has been a gradual change in this direction until at the present time, there is as much attention paid to the use of roughages as to the selection of grain. The feeding of silage for finishing cattle has come into general use with the advent of expensive grains and is becoming more popular every year. A combination of silage, grain, alfalfa hay or cottonseed meal is universally considered an ideal ration for fattening cattle for the market under average feed lot conditions.

—o—

FEEDING TEST—OKLAHOMA EXPERIMENT STATION
FEEDING VALUE OF SILAGE

December 20, 1920
June 23, 1921

Lot No.	I	II	III	IV	V
No. Calves Per Lot	5	5	5	5	5
Ave. Daily Ration, Lbs.	Sunfl'r. S-13.1 Alf. hay 1.03 C. S. M. 1.03 Shelled Corn 11.26	Cane S. 13.1 Alf. hay 1.03 C. S. M. 1.03 Shelled Corn 11.26	Darso S. 13.1 Alf. hay 1.03 C. S. M. 1.03 Shelled Corn 11.26	Corn S. 13.1 Alf. hay 1.03 C. S. M. 1.03 Shelled Corn 11.26	Kafir S. 13.1 Alf. hay 1.03 C. S. M. 1.03 Shelled Corn 11.26
Ave. Initial wt.	428	447	446.6	438.2	444
Ave. Daily Gain	2.13	1.99	2.05	2.08	1.90
Hog Returns Per Calf	$4.90	$5.88	$3.50	$9.52	$9.73
Shrink (lbs.) Per Head	28.66	42	36	59	26

Summary:

No. 1. Sunflower silage showed the best daily gain, corn ranking second, darso third.

No. 2. It will be noted that Lots Four and Five, receiving corn silage and kafir silage respectively showed the largest pork returns. This was undoubtedly due to the grain contained in the corn and kafir silage.

No. 3. The results of this test indicate that the five different kinds of silage used were all of considerable value in producing baby beef.

Points in Favor of Silage for Beef Production:

Silage is the cheapest form in which to provide succulent feed for cattle. An acre of corn can be placed in the silo at a cost of not exceeding that of shocking, husking, grinding or shredding. There is less waste in feeding silage than in feeding fodder. Good silage, properly fed, is all consumed. Silage, like other succulent feeds, has a beneficial effect on the entire system. More beef cattle can be maintained on a given acreage of land throughout the year when silage is the basis of the ration.

Silage Not Good for Horses:

The use of silage for horse feed has not been successful on account of a certain amount of danger from horses eating mouldy silage. Horses are peculiarly susceptible to the effects of mould and it seems that a mould that grows on silage is deadly poisonous to both horses and mules. Mould is more prevalent in Oklahoma in silage because of the sudden changes from cold to warm weather in the winter time. It is also unsafe to feed horses frozen silage on account of the danger of colic.

Silage has been used successfully by some horsemen, but it is essential that absolute care be taken to prevent any mouldy or frozen silage from being fed.

The use of silage for horses is not in general practice and because of the danger of poisoning, it will not prove to be a satisfactory feed for horses.

——o——

SILAGE FOR SHEEP

Pregnant Ewes:

Silage is an excellent feed for pregnant ewes if properly handled. Two or three pounds of silage will replace one pound of hay but it must always be fed in connection with some palatable dry roughage. Do not feed over two or three pounds of silage per head per day and this amount in connection with 1½ pounds of dry roughage. Never feed frozen or mouldy silage as it will cause sickness and abortion. Silage is carbonaceous in nature and must be fed with some feed high in protein such as alfalfa hay, bran, linseed oil meal, etc. Silage is also a good feed for growing lambs and is now very widely used for fattening lambs. It is a roughage and must be fed in connection with dry roughage for fattening lambs as for ewes. For sixty pound lambs a ration of 1 to 1½ pounds silage, makes the gains cheaper but does not increase the rate of gain when fed to fattening lambs.

——o——

DO NOT FEED SILAGE TO HOGS

The digestive tract of the hog is small compared to that of all other classes of animals and it is therefore unable to digest large quantities of

coarse feed. For this reason silage has not proven of value to hog feeding. When silage is fed to hogs they eat the grain that might be present, wasting practically all of the coarser material. A hog can consume a limited amount of dry roughage in the form of alfalfa or other leguminous hays and does exceedingly well on pasture but does not derive any particular benefit from the feeding of silage.

CROPS FOR THE SILO

BY A. DAANE,
Professor of Agronomy.

Corn is our best silage crop but only on the richer bottom lands of the state where it is able to produce a large tonnage. While kafir and cane are but slightly less valuable than corn, their ability to yield under droughty conditions off-sets any advantage that corn may have, because of its slightly increased feeding value. In the greater part of the central and western part of Oklahoma, kafir and cane should be considered the main crops with which to fill the silo. Their yield and adaptability to soil and climatic conditions make them more desirable than corn. Even in the eastern sections of Oklahoma on the poorer uplands these crops are to be preferred rather than corn. Where conditions permit a good tonnage yield of corn, other silage crops need not be given much consideration, but where corn is a doubtful crop, the sorghums should be more largely grown for silage purposes.

In considering varieties of corn for silage, medium to late maturing varieties are to be used because of the greater tonnage. Boone County White, Bloody Butcher, Strawberry, June, Silvermine, Sure Cropper, and Ferguson's Yellow Dent, are quite generally grown in Oklahoma. The yield of forage of the earlier maturing varieties is usually lighter and therefore not so desirable. Close spacing of corn in the row produces a fine stalk, the silage of which is slightly inferior to the heavier stalks, not because of the size of the plant but because of growth and development. Twelve to sixteen inches apart in the row is approximately the spacing desired in planting corn for silage.

Of the grain sorghums, kafir makes the best silage. When there is not enough kafir to fill a silo, milo and feterita may be used. The quality of silage from these sorghums is not quite equal to that of kafir.

Silage from the sweet sorghums is often claimed to be too sour. This is probably caused by cutting the crop when too green or immature. If allowed to grow until the seeds are at least in the dough stage and the silo properly filled, less trouble will be had because of sourness. Orange and Sumac are the most dependable varieties of the sweet sorghums. The Amber varieties are also good but since they are early maturing, the yield is rather low. On the other hand, such late maturing varieties as the Seeded Ribbon produce a very inferior quality of silage in years of adversity because of

immaturity. In years of favorable growth, they produce a greater tonnage of silage than the earlier maturing varieties.

All sorghums and corn should be allowed to mature sufficiently before putting them in the silo. The seed of these crops should be in the dough stage before cutting. However, in case of extreme droughts or if it has been damaged by hot winds, it is better to cut corn and run it in the silo, even if somewhat immature, rather than allow it to remain standing in the field.

Fodder that is somewhat dried out may be made into fair to good silage. However, in using such material, plenty of water should be run in with it in order that it may be well preserved.

SILO BUILDING

Silos are built of wood, metal, brick, stone, concrete, and tile; and the order in which these materials are mentioned is very close to their order of desirability so far as features of durability and quality of service are concerned. The wooden silo is not recommended for Oklahoma, our high wind movement and extremes of relative humidity are very destructive to stave or frame silos even when protected inside the barn, and the annual cost for paint and repairs is heavy. The steel or galvanized iron usually employed in metal construction is acted on by the acids in the silage unless frequent coats of asphaltic paint are applied; this paint is not expensive, but the labor of applying it is considerable and should be taken into consideration when deciding on the relative merits of metal and clay or cement products. Brick makes a desirable silo when well plastered on the inside with two or more coats of cement plaster, but is too porous for use without plastering. It is not so readily reinforced with steel as cement or clay blocks, but lends itself to home building methods better than solid concrete.

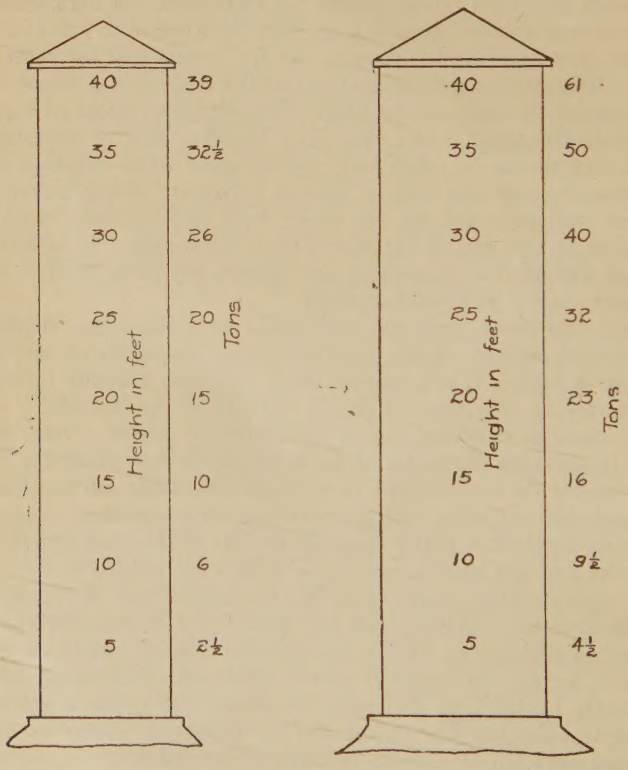
Stone, like brick, presents difficulties in reinforcing, requires two or more coats of cement plaster, requires larger quantities of mortar, and the labor cost is high. Where native stone abounds, and the farmer does his own stone laying, it is often advisable to build of this material.

The monolith concrete silo is recommended where several farmers can organize to purchase the metal forms designed for this work; the use of home made forms for the construction of a single monolithic silo involves too much lumber and difficult labor and the resulting structure is so crude in appearance that as a rule it is better to build the silo in some other way. The concrete blocks and salt glazed hollow tile makes the best units for home methods; the concrete block requires careful plastering next to the silage but the glazed tile does not. Where sand and gravel abound it is recommended that the farmer make his own blocks, using either commercial block machines or home made forms. In localities where sand and gravel must be purchased and probably hauled long distances the glazed tile is the best unit, and the silo of these units has few equals and no superiors insofar as durability of wall and preservation of contents is taken as the criterion.

Capacity

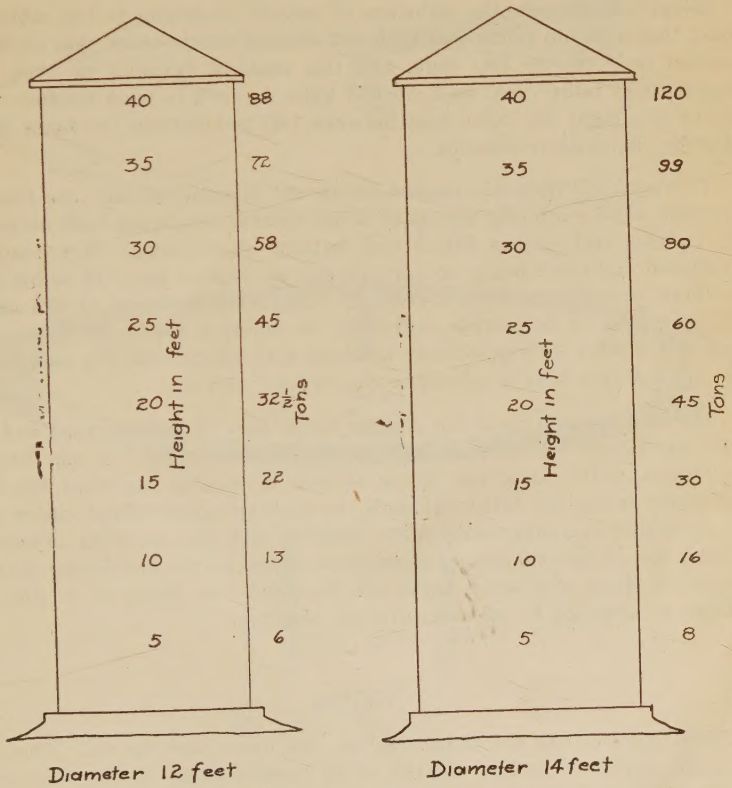
Silage exposed to the air commences to spoil very rapidly during warm weather especially if the humidity is high; in cold weather it remains sweet directly in proportion to the extent of its cooling down to about forty degrees Fahrenheit, at which temperature it remains sweet for several days. It is not safe to feed less than two inches per day from the exposed surface of the silage even in winter because the silage remains quite warm for long periods of time, and it is rare that silage freezes except close to the walls. For this reason it is better to feed off three or four inches per day and thus assure a low percentage of fermented material during warm weather than to feed only about as rapidly as it actually commences to spoil. This calls for a deep storage with a small surface area, hence the advice so frequently given, "Build a tall, slim silo." In this bulletin we are especially interested in the small silo for herds much smaller than generally owned by commercial dairies. It will be noted that the recommendations regarding diame-

Capacity of Round Silos in Tons



Inches Per Ton of Silage

Distance from top in feet	DIAMETER			
	8 ft.	10 ft.	12 ft.	14 ft.
5	24	13½	12	7
10	20	12½	9¼	7½
15	18	11	8¼	6
20	16	10½	7½	5⅜
25	15	9½	6¾	5
30	14	9	6½	4½
35	13	8½	5¾	4¼
40	12½	8	5½	4



ter in ratio to number of animals fed has been reduced due to the fact that most of the tables covering these matters contemplate large herds, cooler weather, and heavier feeding than is likely to be the case in this state. The following table gives the diameters and heights recommended for different numbers of animals and feeding periods.

For ordinary Oklahoma silage, somewhat dry, take two-thirds or three-fourths of the amounts stated.

Inside Height of Silo	Diameter of Silo 8 ft.	10 ft.	12 ft.	14 ft.	Inside Height of Silo	Diameter of Silo 8 ft.	10 ft.	12 ft.	14 ft.
20 feet	17	26	38	51	30 feet	30	47	67	91
21 feet	18	28	41	55	31 feet	31	49	70	96
22 feet	19	30	43	59	32 feet	33	51	74	100
23 feet	20	32	46	63	33 feet	35	53	77	105
24 feet	22	34	49	67	34 feet	36	56	80	109
25 feet	23	36	52	71	35 feet	37	58	84	114
26 feet	24	38	55	75	36 feet	39	61	87	118
27 feet	25	40	58	79	38 feet	41	66	94	128
28 feet	27	42	61	83	40 feet	45	70	101	138
29 feet	28	44	64	87					

Silage packs under the influence of weight according to the table shown above; that is, a silo thirty feet high can contain nearly twice that of the same diameter only twenty feet high, and this packing becomes of even greater importance if rather dry, well ripened kafir or corn is used because the difference in weight per cubic foot between top and bottom increases with the reduction of moisture content.

The most conveniently shaped silo to use is round in plan, the feed chute to prevent wind scattering the silage when thrown out, being built on one side. The circular wall makes filling and settling of the silage very readily accomplished and there being no corners, the spoilage is less. If below ground the chute is omitted. Where brick or homemade concrete blocks are used the form work is somewhat simplified by building the walls hexagonal or octogonal and the interior corners rounded with plaster but if a masonry roof is to be built it is best to adhere to the circular outline.

The best location for a silo is close to the barn or feeding yard and where these are located on or near high banks, the placing of the silo base near the bottom of the bank and filling around it, greatly increases the facility with which it may be filled although the modern power silage cutter readily fills at heights exceeding sixty feet. Success with the silo filler is dependent on sharpness of knives, correct shearing between knives and ledger plate, and uniform feeding, and when these are provided the filling of a silo is not difficult or attended by an excessive use of power.

—o—

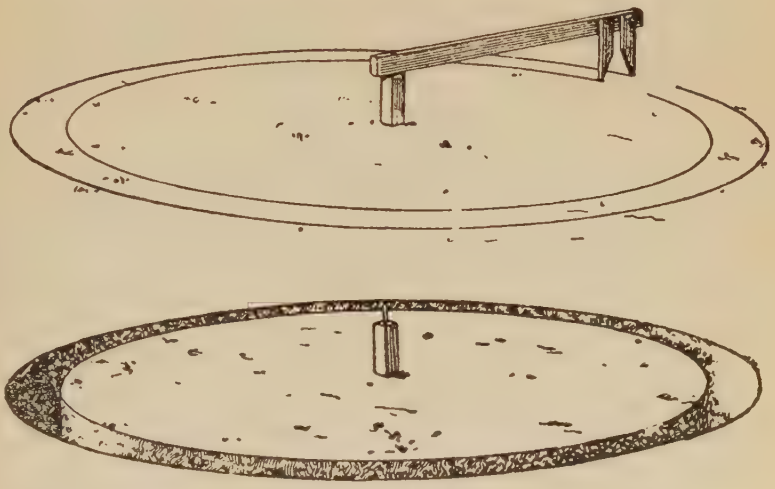
TYPES

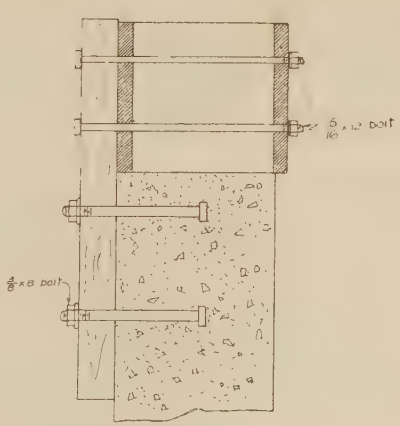
Two types of silo are recommended: the tower and the pit. The former is usually preferred and is adapted to all locations and service requirements of this state, the latter to certain sections where the lower material cost and simplicity of construction combined with a particular type of soil structure makes an underground storage desirable. The tower silo while more difficult to fill, is much easier to feed from than the pit, and for this reason it is recommended in preference to the latter.

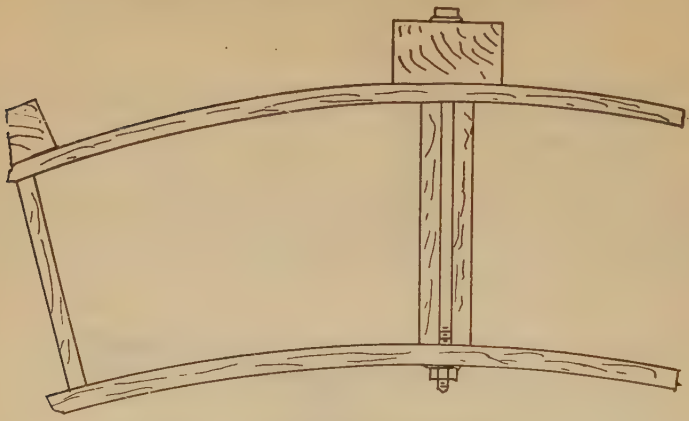
METHODS OF CONSTRUCTION

Foundation

Lay out the foundation with a sweep as shown in Figure 1 and excavate at least five feet. Lay a drain tile as shown in the following drawings. Then place concrete footing rods making the footing two feet wide and eight inches deeper than the floor. In case the tile cannot be readily carried to the hillside it may terminate in a well or pit in open textured soil, otherwise the silo should be set higher and the earth hauled in with a fresno; thorough drainage is very important. Set a trap, perforated cover and tile line from the center of the floor into a tee or wye

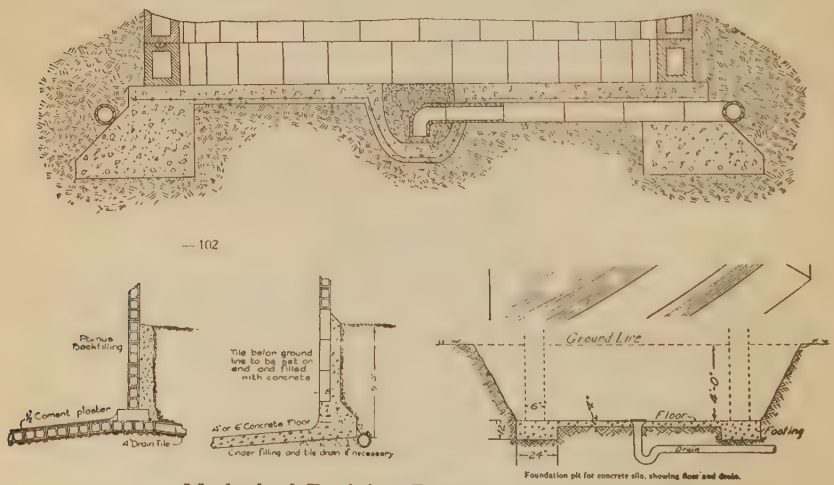






Method of Making Foundation Form

tile in the line thus removing liquid from the bottom of the silo and at the same time insuring an air seal to prevent serious spoilage around the trap lid. The trap may be cast in the concrete by filling an old sock or sleeve with sand and embedding it in the concrete at the time the floor is laid. but it is just as well to procure a standard 4-inch trap and set it. Another method is to leave a funnel shaped opening filled with chat or gravel and bring a tile elbow from it as shown in the sketch, this provides an easily cleaned and repaired trap. In well drained locations where there is no danger of water standing around the foundation, the footing drain may be omitted; but that from the pit itself should always be placed as it relieves the pressure due to accumulation of water in case the silage must be wetted when placed in the silo.



Method of Draining Bottom of Tower Silo

The quantities of cement, sand, gravel, lime and water for the various mixtures are shown in the accompanying table.

Approximate Quantity of Mixing Water Required for Concrete

True Mix (by volume)		Approximate Field Mix by Volume (Damp aggregates measured loose)			Approximate Total Quantity of Water
Volume of Cement 1 Cu. Ft. 94	Volume of Combined Dry Aggregate (rolled)	Cement	Aggregate		Gallons Per Sack of Cement
			Fine	Coarse	
1	2¾	1	1¼	2½	5 to 5½
1	3¼	1	1½	3	5½ to 6
1	3¾	1	2	3	5¾ to 6¼
1	4½	1	2	4	6 to 6½
1	5½	1	2½	5	7¼ to 7¾
1	6¾	1	3	6	8¼ to 8¾

Concrete Mixtures

Per Sack of Cement

Purpose	Quarts of Lime	Sacks of Sand	Sacks of Gravel	Gallons of Water
Foundation	2	2½	5	7
Floor Surface	3	3	----	6
Solid Walls	3	2½	4	6
Solid Blocks	3	2	3	5
Hollow Blocks	4	2½	----	5
Roof	3	2	3	6

If it is found possible to reduce the quantity of water and still secure a workable mix, a stronger concrete will be the result providing it can be protected against drying. Blocks should be kept in a moist place such as under a straw pile or covering of earth for at least two weeks, and a month is better. Water sprayed on the walls every few days will assist in securing a proper curing of mortar joints. It should be clearly understood than an excess of water makes concrete porous and rapid drying makes it weak. Next to the quantity of water in importance is the placing of the mix into the forms. The best concrete is made by spading or rodding into place with some force so that a maximum density may be secured; if too wet the aggregate tends to sink and the cement come to the top, while if too dry it is difficult to compact the entire mass properly. The use of proper quantities of clean water is very important, an excess or deficiency of water greatly reduces the ultimate strength of the concrete; too much water separates the grains of cement and prevents their close sealing together, too little causes part of the cement to remain unhydrated, the loss in strength is greater from an excess than from a corresponding deficiency, therefore the usual practice of mixing very wet batches is to be guarded against. The best rule is to use the mixture as dry as it can readily be made and still obtain sufficient plasticity for ready placing in the forms, and the water should be carefully measured for each batch just as the other ingredients are. The use of hydrated lime is recommended for two reasons: first, it increases the plasticity of

mortar and concrete; second, it reduces the coefficient of absorption, thus making more water-proof concrete. The use of an excess of lime is injurious to the strength of the resultant concrete, therefore careful measurement of lime and thorough mixing with the dry cement is very essential. Do not use lump or unslaked lime as it will slake during setting and ruin the concrete. Lime putty is sometimes used but is so difficult to mix with the other constituents that it cannot be recommended for use except where a power concrete mixer is available.

The use of dirty sand or gravel is dangerous as the soil coating prevents the cement adhering, and a costly failure may result; dirty crushed rock may be washed with a hose, but sand must be washed through a trough as directed below.

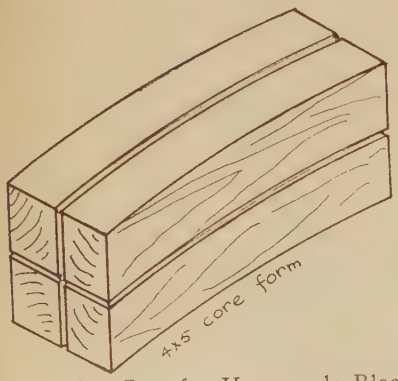
Build a trough somewhat wider than a square ended shovel and from ten to sixteen feet in length. If running water is available set the trough at a slight slope and scatter the sand along its length permitting the water to overflow at one end, stir the sand thoroughly until discoloration of the water ceases; the quantity washed at any one time should not exceed a depth of three inches, and if quite dirty less than two will obtain more economical expenditure of labor and water. Where running water is not available the washing may be accomplished by setting the trough level and stirring the sand vigorously by hand or shovel then suddenly tilting the trough endwise to drain off the dirty water before the dirt commences to settle. For making concrete to be used in homemade molds the foregoing method is adequate because only a limited amount of material is used each day but when pouring in molds for monolithic construction it is best to secure washed sand by some other means unless adequate storage for clean sand is available.

Do not use bank run gravel for concrete work; screen it carefully and remix according to the proportions recommended. A strong concrete from bank run gravel is not likely to be secured without an excessive use of cement, and in silo work density and strength are of paramount importance while the desire for economy in cost inclines the builder to be sparing in the use of cement and seek to obtain plasticity by using an excess of lime.

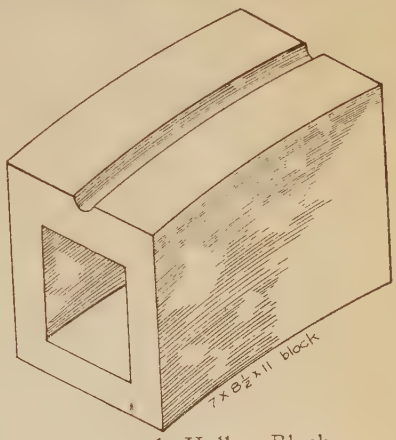
Silo Forms

The use of commercial forms is to be encouraged; these forms insure a satisfactory result with a minimum of effort, and where blocks are used the form cost is only a small fraction of the total for even as small as an 8x20 silo. In many cases forms can be rented and this arrangement is often to be preferred. But the use of commercial forms is not necessary. Fig. 3 shows an excellent method of making a low priced form for either hollow or solid blocks using as a base the foundation of the silo; two sets of blocks can be poured each day and laid to cure under earth or wet straw. The core form is fastened with a piece of tin and short tacks at each end; where the concrete is poured in the mold the core is wrapped with waxed paper and laid in the concrete and the filling of the form completed. When the block has set the core form is easily removed because it collapses toward the center and is prevented from sticking to the concrete by the paper. It is well to line the

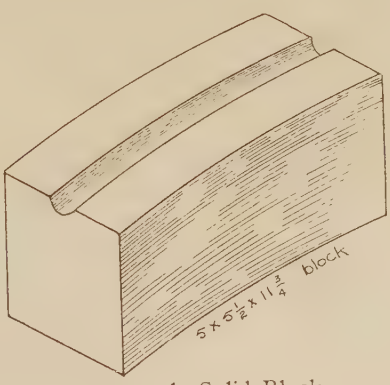
outside forms with paper also. Special attention is directed to the fact that each side of the core form has the crevice between pieces covered with a strip of galvanized metal to avoid a key being formed by the mix entering the crevice due to yielding of the wax paper. Sheet metal such as 18-guage galvenized iron may well be substituted for form sides in place of the boards, especially for the short curves of the blocks often used in chutes and roofs.



Wooden Core for Homemade Block



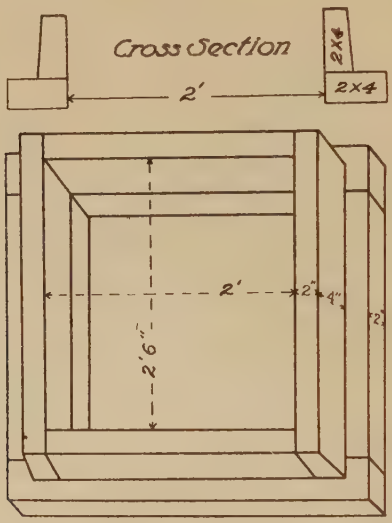
Homemade Hollow Block



Homemade Solid Block

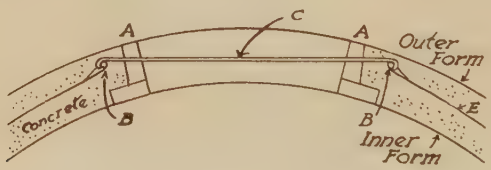
The chute form is bent in the same manner as that for the wall and the blocks, cored or solid, made on a 2 ft. 6 in. inside radius or may be made on straight lines for a chute 2 ft. 6 in. square, these blocks being the same height as those of the silo and 5x9¾ in plan. The chute must be tied to the silo by wires or rods brought out from the silo reinforcement and laid in the mortar joints of the chute. It is not necessary to cast grooves in the chute blocks as the reinforcement in this part of the silo serves merely as a tie between the two structures because the usual bonding is, as a rule, omit-

ted. It would be possible to bond the chute by overlapping every other course with a silo block in the usual manner of laying masonry walls and leave the reinforcement out of the chute entirely but the execution of the work would as a rule be more difficult because of placing the door forms and ramming the concrete into them. In block silos the intermittent door is preferable and the forms for the frame opening is shown herewith. Win-



Form for Intermittent Doorway

dow openings every ten feet or so should occur in the chute so that sufficient light may be admitted for leveling the silage without the use of a lantern. The reinforcing rods which terminate against the door openings are hooked



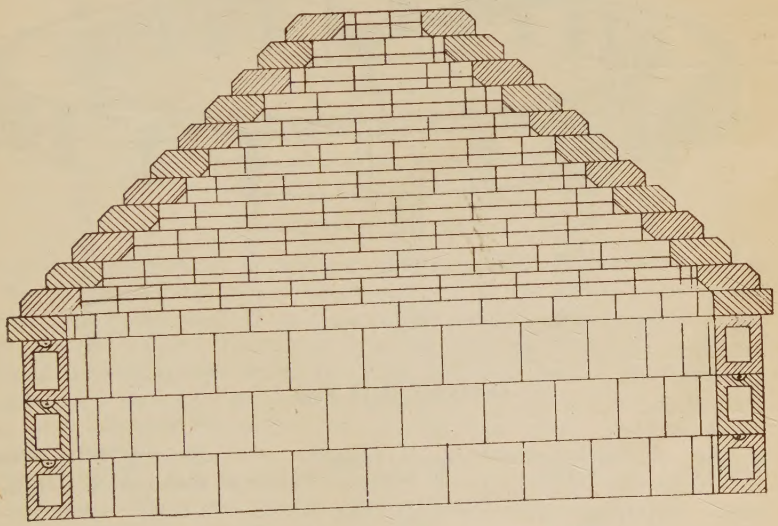
Form for Continuous Doorway

around ⅝ inch vertical bars. The forms for lintels over the windows are very simple and the placing of the reinforcement should be ½ to 1 inch from the bottom of the beam. It should be noted that the steel in a lintel should be carefully placed so as to be near the bottom of the form, otherwise it loses its value as a tensil reinforcement and the lintel may bend, thus cracking across the bottom.

The positions of No. 3 wire reinforcement rods are indicated in the following table:

Distance From Top of Silo	Diameter of Silo (inside)			
	8 ft.	10 ft.	12 ft	14 ft.
Feet	1	1	1	1
	0	0	0	0
2	1	1	1	1
	0	0	0	0
4	1	1	1	1
	1	1	1	1
	0	0	0	0
6	1	1	1	1
	0	0	0	0
	1	1	1	1
8	0	0	0	0
	1	1	1	1
	0	0	0	1
10	1	1	1	1
	0	0	1	1
	1	1	1	1
12	0	0	1	1
	1	1	1	1
	0	1	1	1
14	1	1	1	1
	0	1	1	1
	1	1	1	1
16	1	1	1	1
	1	1	1	2
	1	1	1	1
18	1	1	1	2
	1	1	1	1
	1	1	1	2
20	1	1	1	1

Distance From Top of Silo	Diameter of Silo (inside)			
	8 ft.	10 ft.	12 ft	14 ft.
	1	1	2	2
	1	1	1	1
22	1	1	2	2
	1	1	1	1
	1	1	2	2
24	1	1	1	1
	1	1	2	2
	1	2	1	2
26	1	1	2	2
	1	2	1	2
	1	1	2	2
28	2	2	1	2
	1	1	2	2
	2	2	1	2
30	1	1	2	2
	2	2	2	2
	1	1	2	2
32	2	2	2	2
	1	1	2	2
	2	2	2	2
34	1	1	2	2
	2	2	2	3
	1	1	2	3
36	2	2	2	3
	1	2	2	4
	2	2	2	3
38	2	2	2	3
	2	2	2	4
	2	2	2	3
40	2	2	2	3



Method of Making Concrete Block Roof

Table for the casting of the concrete blocks for the conical block cover on the concrete silo.

Diameter of the Silo, 8 Feet

Round	Circumference in Feet	Length of Block in Inches	Number of Blocks	Width of Mortar Joints Approximately in Inches
1	25.14	11½	25	⅝
2	23.1	11½	23	½
3	21.0	11½	21	½
4	18.85	11¼	19	⅝
5	16.50	10½	18	½
6	14.66	10½	16	½
7	12.60	11	13	⅝
8	10.50	11	10	½
9	8.33	9½	10	½
10	6.28	10¼	7	½
11	4.2	12	4	½

Diameter of 10 Feet

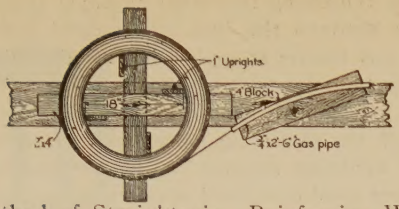
Round	Circumference in Feet	Length of Block in Inches	Number of Blocks	Width of Mortar Joints Approximately in Inches
1	31.41	11¼	32	½
2	29.33	11¼	30	½
3	27.2	11½	27	½
4	18.85	11¼	19	⅝
5	16.50	10½	18	½
6	14.66	10½	16	½
7	12.60	11	13	⅝
8	10.50	11	10	½
9	8.33	9½	10	½
10	6.28	10¼	7	½
11	4.2	12	4	½

Diameter of 12 Feet

Round	Circumference in Feet	Length of Block in Inches	Number of Blocks	Width of Mortar Joints Approximately in Inches
1	37.6	11	39	½
2	35.6	10¾	38	½
3	33.5	11½	34	½
4	18.85	11¼	19	⅝
5	16.50	10½	18	½
6	14.66	10½	16	½
7	12.60	11	13	⅝
8	10.50	11	10	½
9	8.33	9½	10	½
10	6.28	10¼	7	½
11	4.2	12	4	½

Diameter of 14 Feet

Round	Circumference in Feet	Length of Block in Inches	Number of Blocks	Width of Mortar Joints Approximately in Inches
1	44	11½	44	½
2	42	11½	42	½
3	39.8	11½	40	½



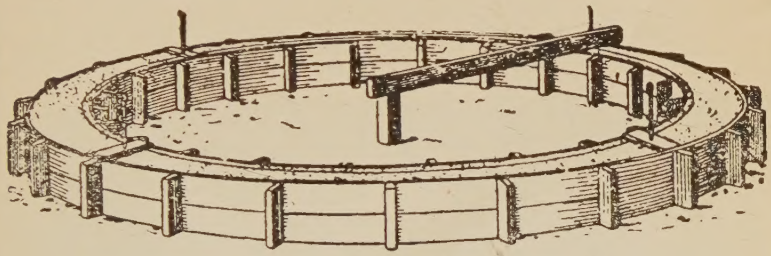
Method of Straightening Reinforcing Wire

The Pit Silo

Owing to its low cost of construction the pit silo is being built in localities where the natural water table is deep enough to obviate difficulty from standing water. In many soils it is possible to plaster directly to the earth and secure a reasonably secure, durable wall. Where this is done the plastering should be carried down as the digging progresses, and at least three coats of cement plaster applied. It is well to paint the finished plaster with asphaltum although this is often omitted and satisfactory results still accrue.

To keep the cylinder true the digging is gauged by a vertical pipe and sweep as illustrated in the diagram; in some cases it is well to forge a blade for shaving the earth to a smooth outline, but usually this is accomplished so as to be sufficiently true by careful use of a tile spade.

The upper portion of the cylinder should be protected by a concrete



Foundation of Pit Silo

ring to a depth below frost, in this state the ring should extend not less than three feet below the surface of the ground, and if the silo is to stand uncovered during winter weather the ring should extend six or more feet below and at least two above. To prevent cracking the ring should be reinforced with No. 3 wire using one strand every six inches of depth. No forms are necessary, use a post hole jabber for digging the trench. A day or so after placing the concrete commence excavating the earth and plastering the walls, using a windlass for lifting. If a wooden roof is desired bolts should be placed in the last course of concrete poured for the ring to fasten the plate. Treat the wooden plate members with creosote oil. Bolts should occur not further than four feet apart.

In soils too friable to hold plaster firmly the cylinder should be constructed by placing meshed steel wire firmly against the first coat of plaster

and then applying the remaining two coats to cover the wire thus making a strong reinforcement between the first and second coats. Sometimes the wire is placed before any plaster is applied but usually difficulty is encountered in fully enveloping the wire with plaster.

It is best to use just as little lime in the mortar as consistent with easy troweling, and to push the plaster in place more firmly than generally considered necessary in applying gypsum or cement plasters in other places. Use not over three parts sand to each of cement.

We would always recommend that the pit silo be covered just as is the tower silo and that a hoist be permanently incorporated. The portion above ground should be not less than ten feet. Where farm electric plants are available an electric hoist is quite a time saver, in other cases a team of horses makes short work of hoisting. The hoist most satisfactory is the commercial design of barn hay track and carrier; this not only lifts the silage but conveys it away from the silo as well.